



OFFICE OF THE REGISTRAR :: DIBRUGARH UNIVERSITY :: DIBRUGARH

Ref. No. DU/DR-A/Syllabus-PE (III to VIII)/2024/025

Date: 08.01.2024

NOTIFICATION

As recommend by the *126th Meeting* of the Under Graduate Board held on 23.11.2023, the 129th Meeting of the Academic Council, Dibrugarh University held on 08.12.2023 vide *Resolution No. 08* has approved the Course Structure and Syllabus (for the Semesters – III to VIII) of B. Tech. Programme in Petroleum Engineering at Dibrugarh University Institute of Engineering & Technology (DUIET), Dibrugarh University w.e.f. the academic session 2023-2024 (for the batches 2023 onwards).

The Course Structure and Syllabus is enclosed herewith.

Issued with due approval.

Sadiq Hossain
Deputy Registrar (Academic) i/c
Dibrugarh University

Shelvi

Copy for kind information and necessary action to:

1. The Hon'ble Vice-Chancellor i/c, Dibrugarh University.
2. The Deans, Dibrugarh University.
3. The Registrar, Dibrugarh University.
4. All the Heads and Chairpersons of the Teaching Departments and Centres of Studies, Dibrugarh University.
5. The Director, DUIET, Dibrugarh University.
6. The Head i/c, Dept. of Petroleum Engineering, DUIET, Dibrugarh University.
7. The Controller of Examinations i/c, Dibrugarh University.
8. The Inspector of Colleges, Dibrugarh University.
9. The Director, IQAC, Dibrugarh University.
10. The Joint / Deputy Controller of Examinations – 'B', 'C' & 'A', Dibrugarh University.
11. The Programmer, Dibrugarh University with a request to upload the notification in the Dibrugarh University Website.
12. File.

Sadiq Hossain
Deputy Registrar (Academic) i/c
Dibrugarh University

Shelvi

**Course Structure and Content of Department of Petroleum Engineering,
DUIET, Dibrugarh**

(For the Batch admitted in 2023 onwards)

Semester III (Second year)

Curriculum Branch/Course: Petroleum Engineering

Course Code	Course Title	Credit Structure			Total Credit	Contact hours
		L	T	P		
BS-301	Mathematics- III	3	1	0	4	4
PE/ME-301	Mechanical Engineering	3	0	0	3	3
PE-301-T	Geology for Petroleum Engineers	3	0	0	3	3
PE-301-P	Geology for Petroleum Engineers Lab	0	0	1	1	2
SBC-PE -301-T	Principles of Drilling Engineering	3	0	0	3	3
SBC-PE -301-P	Drilling Engineering Lab.	0	0	1	1	2
PE-302-T	Chemistry of Petroleum and Petroleum Refining	3	0	0	3	3
PE-302-P (A)	Petroleum Refining and Product Testing Lab	0	0	1	1	2
PE-302-P (B)	Chemistry of Petroleum Lab	0	0	1	1	2
HSMC-301	Indian Knowledge System	2	0	0	1	2
MC-301	Internship-I (Social and Rural Internship)	0	0	0	3	0
Total		17	1	4	24	26

Semester IV (Second year)
Curriculum Branch/Course: Petroleum Engineering

Course Code	Course Title	Credit Structure			Total Credit	Contact hours
		L	T	P		
BS-401	Numerical Methods	2	1	0	3	3
PE-401	Sedimentary and Petroleum Geology	3	0	0	3	3
PE-402-T	Principles of Surveying and Remote Sensing	3	0	0	3	3
PE-402-P	Principles of Surveying and Remote Sensing Lab	0	0	1	1	2
PE-403-P	Production Engineering-I	3	0	0	3	3
PE-402	Reservoir Engineering	3	0	0	3	3
PE/ECE-401	Instrumentation and Control system	3	0	0	3	3
HSMC -401	Technical English	2	0	0	1	2
	Total	19	1	1	20	22

Semester V (Third year)

Curriculum Branch/Course: Petroleum Engineering
Major

Course Code	Course Title		Credit Structure			Total Credit	Contact hours
			L	T	P		
HSMC-501	Managerial Economics and Accountancy		2	1	0	3	3
PE-501-T	Production Engineering-II		2	1	0	3	3
PE-501-P	Production Engineering Lab		0	0	1	1	2
PE-502-T	Advanced Reservoir Engineering		3	0	0	3	3
PE-502-P	Reservoir Engineering Lab		0	0	1	1	2
PE-503	Reservoir Modeling and Simulation		3	0	0	3	3
PE-CEIv.-501(1)	Core	Designs of Drilling Engineering	2	1	0	3	3
PE-CEIv.-501(2)	Elective-I	Well Control Systems					
PE-CEIv.-502(1)	Core	Petrochemicals	3	0	0	3	3
PE-CEIv.- 502 (2)	Elective-III	Unit Operations					
MC-501	Internship II (Academic Internship)		0	0	0	4	0
AU-501	Profession Ethics		0	0	0	0	0
PE/CSE-501	Artificial Intelligence and Machine Learning		3	0	0	3	3
Total			19	3	2	27	25

Semester VI (Third year)
Curriculum Branch/Course: Petroleum Engineering

Course Code	Course Title		Credit Structure			Total Credit	Contact hours
			L	T	P		
PE-OElv.-601	Principles of Water Flooding (Open Elective-II)		3	0	0	3	3
PE-CElv.-601(1)	Core Elective-IV	Petroleum Exploration-I	3	0	0	3	3
PE-CElv.-601(2)		Micropaleontology in Fossil Fuel Industry					
PE-602	Advanced Drilling Engineering		3	0	0	3	3
PE- 603	Natural Gas Engineering		3	0	0	3	3
PE-CElv.-602 (1)-T	Core Elective-II	Enhanced Oil Recovery	3	0	0	3	3
PE-CElv.-602 (2)		Net Zero Carbon Strategies Integration					
PE-CElv.-602 (3)		Reservoir Geomechanics					
PE-CElv.-602 (1)-P	Enhanced Oil Recovery Lab		0	0	1	1	2
PE-604	Pipeline Engineering		2	1	0	3	3
HSMC-601	Constitution Of India		0	0	0	0	0
Total			17	1	1	19	20

Semester VII (Fourth year)
Curriculum Branch/Course: Petroleum Engineering

Course Code	Course Title		Credit Structure			Total Credit	Contact hours
			L	T	P		
PE- 701	Oil and Gas Well Testing		3	0	0	3	3
PE-OElv.-701	Petroleum Exploration-II (Open Elective-IV)		3	0	0	3	3
PE-CElv.-701(1)	Core Elective -V	Core Analysis	3	0	0	3	3
PE-CElv.-701(2)		Advanced Production Engineering and Management					
PE-702	Offshore Operations		3	0	0	3	3
PE-703	Petroleum Formation and Evaluation		2	0	0	2	2
PE-P-701	Project-I		0	0	0	4	4
MC-701	Internship III (Industrial Training)		0	0	0	4	3
Total			14	0	0	22	21

Semester VIII (Fourth year)
Curriculum Branch/Course: Petroleum Engineering

Course Code	Course Title		Credit Structure			Total Credit	Contact hours
			L	T	P		
PE-OElv.-801(1)	Open Elective-V	(1) Energy Economics	3	0	0	3	3
PE-OElv.-801(2)		(2) Computational Fluid Dynamics					
PE-801	Occupational Health and Safety		3	0	0	3	3
PE-CElv.-801(1)	Core Elective - VI	(1) Unconventional Energy	3	0	0	3	3
PE-CElv.-801(2)		(2) Shale Gas/Oil					
PE-P-801	Project-II		0	0	0	4	4
PE-C-801	Composite Viva- Voice		0	0	0	2	2
	Total		9	0	0	15	15

COURSE CONTENT

3RD SEMESTER

SUBJECT: MATHEMATICS-III

BS-301

3L-1T-0P:04 Credits

Objectives:

- (1) To introduce the solution methodologies for second order Partial Differential Equations with applications in engineering
- (2) To provide an overview of probability and statistics to engineers

Contents:

Module 1: Partial Differential Equations (16 hours)

Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method. Second-order linear equations and their classification, Initial and boundary conditions, D'Alembert's solution of the wave equation; Duhamel's principle for one dimensional wave equation. Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variables.

Module 2: Basics of Probability (10 hours)

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality. Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities. Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule

Module 3: Basic Statistics (14 hours)

Measures of Central tendency: Moments, skewness and Kurtosis- Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, Tests for single mean, difference of means, and difference of standard deviations. Test for ratio of variances - Chi- square test for goodness of fit and independence of attributes

Textbooks/References:

1. AICTE Prescribed Textbook: Mathematics – II (Probability and Statistics), ISBN: 978-93-91505-41-7
2. Reena Garg, Engineering Mathematics, Khanna Book Publishing Company, 2022.
3. Reena Garg, Advanced Engineering Mathematics, Khanna Book Publishing Company, 2021.
4. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint)
7. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

Course Outcomes:

Upon completion of this course, students will be able to solve field problems in engineering involving PDEs. They can also formulate and solve problems involving random variables and apply statistical methods for analysing experimental data.

SUBJECT: MECHANICAL ENGINEERING

PE/ME-301 3L-0T-0P:03 Credits

UNIT I

Fundamental Concepts of Thermodynamics:

Introduction and Definition of thermodynamics System, Macroscopic & microscopic approaches, System, Surrounding and universe, Phase, Concept of continuum, Density, Specific volume, Pressure, temperature. Thermodynamic equilibrium, Thermodynamic Properties, State, Path, Process, Cyclic and non cyclic processes, Reversible and irreversible processes, Quasi static process Energy and its forms, Work and Heat, Enthalpy.

UNIT II

Fundamental Concepts of Thermodynamics and Properties of Steam:

Zeroth law of thermodynamics, First law of thermodynamics. Processes - flow and non -flow, Control volume, Flow work and non - flow work, Steady flow energy equation, Unsteady flow systems and their analysis. Second law: Limitations of first law of thermodynamics Essence of second law, Thermal reservoir, Heat engines. COP of heat pump and refrigerator. Statements of second law and their equivalence, Carnot cycle, Cannot theorem, Thermodynamic temperature scale, Clausius inequality. Concept of entropy.

UNIT III

Properties of Steam:

Properties of steam, Phase transformation process and its graphical representation on P-V, T-V & T-s diagram, Steam Tables, Processes involving steam in closed and open systems. Introduction to I.C. Engines: Two & four stroke Si and C.I. engines. Otto cycle, Diesel cycle, Dual cycle.

UNIT IV

Fluid Mechanics:

Definition of fluid, types of fluid, Properties of fluids, fluid statics, Forces on fluids, Newton's law of viscosity, pressure depth relationship for compressible and incompressible fluids, Fluid flow: Laminar, Transitional and turbulent flows, fluid flow through a circular tube or pipe: Hagen-Poiseuille equation, Bernoulli's equation, Pressure drop in pipes, Friction Losses in Laminar flow and Turbulent flow, Continuity Equation, Flow measuring devices for petroleum industries: venturimeter, orifice meter, Rotameter, Pumping of oil and gas, reciprocating pumps and centrifugal pumps, NPSH calculations.

UNIT V

Heat Transfer and Mass Transfer:

Introduction to heat transfer and general concepts of heat transfer by conduction and convection, Conduction: Basic concepts of conduction in solids, liquids, gases, steady state temperature fields and one dimensional conduction without heat generation e.g. through plain walls, cylindrical and spherical surfaces, composite layers, etc. Insulation materials, critical and optimum insulation thickness, Convection: Fundamentals of convection, Basic concepts and definitions, Heat transfer equipment: types of exchangers, viz. double pipe, shell and tube, heat transfer calculation for co-current and counter-flow double pipe heat exchanger: LMTD and overall heat transfer. Condensation of pure vapors, film wise on vertical and horizontal tube.

BOOKS:

1. Holman, J.P.: "Thermodynamics, Tata McGraw Hill book Co. NY.
2. Nag, P.K.: Basic and Applied Thermodynamics, Tata McGraw Hill, New Delhi (2009)
3. Rajput, R.K., "Text Book of Fluid Mechanics", S. Chand and Co., New Delhi (1998).
4. Bansal, R.K., "Fluid Mechanics and Hydraulic Machines", Laxmi Publications (P) Ltd., New Delhi (2005).
5. Kern, D.Q., "Process Heat Transfer", McGraw Hill Book (1950).
6. Dutta, B.K., "Heat Transfer: Principles and Application", Prentice-Hall of India Pvt. Ltd., New Delhi (2004)
7. Nag, P.K.: Heat and Mass Transfer, McGraw Hill, New Delhi

SUBJECT: GEOLOGY FOR PETROLEUM ENGINEERS

PE-301-T

3L-0T-0P:03Credits

1. Mineralogy: Introduction to minerals: General properties; Classification of minerals and properties of common rock forming minerals.
2. Petrology: Introduction to rocks; Classification and description of some common rocks.
3. Stratigraphy: Principles of stratigraphy; Broad stratigraphic subdivisions and associated rock types of important coal belts and oil fields of India.
4. Concepts of palaeontology; Fossils, their mode of preservation and significance as indices of age and climate; Concept of index fossils;
5. Structural Geology: Unconformities, folds, faults and joints – their nomenclature, classification and recognition, Effects of folds and fractures on strata and their importance in exploration activities.
6. Forms of igneous intrusions - dyke, sill and batholith.
7. Interpretation of topographic (structural) maps; Attitude of planar and linear structures; Effects of topography on outcrops.

SUBJECT: GEOLOGY FOR PETROLEUM ENGINEERS LABORATORY

PE-301-P

0L-0T-1P: 01 Credit

1. Rock thin-section study, Identification of optical properties of rock forming minerals under petrological microscope
3. Study of diagenetic alterations in reservoir rock
4. Grain size analysis and its interpretations with reference to reservoir characteristics
5. Construction of geological maps and cross-section.
6. Construction of sub-surface maps using exploration data.

SUBJECT: PRINCIPLES OF DRILLING ENGINEERING

SBC-PE-301-T

3L-0T-0P:03Credits

1. Well Planning: Introduction to oil well drilling, Drilling planning approaches.
2. Rotary Drilling Method: Rig parts, selection and general layout.
3. Drilling Operations & Practices: Hoisting, Circulation, Rotation, Power system, Well Control System
4. Well tubular: Casing String and Drill String
5. Drill Bits: Classification and design criteria of drag, rotary, roller, diamond and PDC bits, Bit Selection.
6. Coring: Different methods of core drilling.
7. Well Problems and Solutions: Fatigue failure, Pipe sticking, Lost-circulation, Sloughing shale, Swabbing, surge, gas cap drilling.
8. Oil Well Fishing: Fish classification, tools and techniques.
9. Well Head Testing, Hermetical Testing

SUBJECT: DRILLING ENGINEERING LAB

SBC-PE-301-P

0L-0T-1P: 01Credits

1. Determination of Density/Specific Gravity of drilling fluid sample.
2. Determination of Funnel Viscosity of drilling fluid.
3. Determination of rheological properties such as plastic viscosity, gel strength etc. of drilling fluid
4. Determination of filtration /fluid loss of a given drilling fluid.

SUBJECT: CHEMISTRY OF PETROLEUM AND PETROLEUM REFINING

PE-302-T

3L-0T-0P:03Credits

PART A: CHEMISTRY OF PETROLEUM (Credit= 1.5)

1. Advance electrochemistry: Reversible and irreversible cells; Fuel cells; Reference electrodes and indicator electrodes; Ion selective electrodes; Application of electrode potentials; Potentiometric titration;
2. Corrosion and corrosion control: Principles of corrosion, methods of corrosion control, cathodic and anodic protection, corrosion inhibitors. Surface coatings, Corrosion Monitoring. Case Studies of Corrosion in Petroleum industry including metals and alloys used in Petroleum Industry.
3. Advanced surface chemistry: Interfacial phenomena; Wetting; Surface tension measurements; Electrokinetic phenomena; Zeta potential and its measurement. Adsorption: Types of adsorption isotherm, Gibb's adsorption equation, BET equation, surface area of adsorbents, Application of Adsorption on the surface of solids, adsorption of high molecular compounds.
4. Analytical techniques: UV-Vis Spectrophotometry, Atomic Absorption Spectrophotometer (AAS), IR Spectroscopy, Liquid and Gas Chromatography and Solvent extraction methods.

Text/Reference Books -

1. A Textbook of Engineering Chemistry- ShashiChaula
2. Engineering Chemistry-Wiley (India) Publication
3. Organic Spectroscopy- William Kemp

Part -B: PETROLEUM REFINING (Credit= 1.5)

1. Composition of Petroleum: Physical properties of Petroleum. Crude classification, Evaluation of crude oil. Refinery products - specifications, properties, test methods. Additives and their uses.
2. Refinery Equipment Design: Pipe still heater. Distillation column, Heat exchangers and condensers.

3. Petroleum Refining Process: Multi-component distillation. Coking, Cracking, Reforming, alkylation, Isomerisation, Hydro-processes.
4. Specialty Products: Lube Oil Production, Propane De-asphalting, solvent extraction, De-waxing, Hydro-finishing. Wax Production, Carbon black & Petroleum Coke Production.

Text/Reference Books -

1. Modern Petroleum Refining Processes- B. K. Bhaskar Rao
2. Petroleum Refining Engineering- W. L. Nelson
3. Petrochemical Technology Assessment- John Wiley
4. Petrochemicals – B. K. Bhaskar Rao

SUBJECT: PETROLEUM REFINING AND PRODUCT TESTING LABORATORY

PE-302-P (A)

0L-0T-1P: 01Credit

- (i) Determination of ductility of bitumen.
- (ii) Copper strip corrosion experiment
- (iii) Softening point determination of bitumen
- (iv) Specific gravity experiment
- (v) pH, salinity determination
- (vi) Cetane number and octane number of fuel
- (vii) Viscosity of fuel
- (viii) Smoke point of kerosene
- (ix) Flash point and fire point of fuel
- (x) Reid vapor pressure of fuel

SUBJECT: CHEMISTRY OF PETROLEUM LAB

PE-302-P (B)

0L-0T-1P: 01Credits

List of Experiment

1. To determine the strength of a given CH_3COOH solution by titrating against a standard NaOH solution by conductometric titration.

2. To determine the amount of chloride ions in the given KCl solution by precipitation titration.
3. To determine the strength of an unknown solution of HCl by titrating it with NaOH solution by using pH meter.
4. To determine average molecular weight of polyvinyl acetate by viscosity measurement.
5. To learn the basic principles of UV-visible spectrophotometry and to measure concentration by a UV-visible spectrophotometer.
6. To learn the instrumentation of IR spectroscopy and to analysis IR spectra of three organic molecules.

SUBJECT: INDIAN KNOWLEDGE SYSTEM

HSMC-301

2L-0T-0P: 0 Credits

4TH SEMESTER

SUBJECT: NUMERICAL METHODS

BS-401

2L-1T-0P: 03 Credits

Course Contents:

Module 1 (4 hours):

Interpolation by polynomials, error of the interpolating polynomial, piecewise linear and cubic spline interpolation.

Module 2 (6 hours):

Numerical integration, Simpson rule, composite rules, error formulae, Gauss quadrature.

Module 3 (8 hours):

Solution of a system of linear equations, implementation of Gaussian elimination and Gauss-Seidel methods, partial pivoting, row echelon form, LU factorization, Cholesky's method, ill-conditioning, norms.

Module 4 (6 hours):

Solution of a nonlinear equation, bisection and secant methods. Newton-Raphson method, rate of convergence, solution of a system of nonlinear equations.

Module 5 (10 hours):

Numerical solution of ordinary differential equations, Euler and Runge-Kutta methods, multistep methods, predictor-corrector methods, order of convergence, finite difference methods, numerical solutions of elliptic, parabolic, and hyperbolic partial differential equations.

Module 6 (6 hours):

Eigenvalue problem, power method, QR method, Gershgorin's theorem. Exposure to software packages like MATLAB.

Text/Reference Books:

1. S. D. Conte and Carl de Boor, Elementary Numerical Analysis an Algorithmic Approach (3rd Edition), McGraw-Hill, 1980.
2. C. E. Froberg, Introduction to Numerical Analysis (2nd Edition), Addison-Wesley, 1981.
3. E. Kreyszig, Advanced engineering mathematics (8th Edition), John Wiley (1999).
4. Reena Garg, Advanced Engineering Mathematics, Khanna Book Publishing (2022).
5. K. E. Atkinson, An Introduction to Numerical Analysis (2nd edition), Wiley-India, 1989
6. R. Agor, Elements of Mathematical Analysis, Khanna Publishing House, 2015.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand the use of Interpolation and Implement different interpolation schemes.
2. Understand different numerical integration techniques, and numerically solve differential equations.
3. Find roots of a transcendental equation using different methods.
4. Perform various matrix computations and solve simultaneous linear equations.

SUBJECT: SEDIMENTARY AND PETROLEUM GEOLOGY

PE-401

3L-0T-0P: 03Credits

SECTION – A (Sedimentary Geology)

1. Introduction: Sedimentary processes, Textural properties, Sedimentary structures, Sedimentary environment, Reconstruction of sedimentary environment
2. Pore morphology and its significance, important rock groups with special reference to sandstones and carbonates, Role of sedimentology in petroleum exploration.
3. Tectonics, basic concept of sequence stratigraphy, Elements of basin modeling.

SECTION – B (Petroleum Geology)

1. Physical and chemical characteristics of crude oil
2. Origin of petroleum, Source rock and maturation, Reservoir rocks and cap rocks
3. Migration of hydrocarbons: mechanism, pattern and barriers.
4. Entrapment of oil and gas: types and mechanism.
5. Geology of sedimentary basins of India –producing and prospective basins.

Text/Reference Books -

1. Boggs, S.Jr., 1987, Principles of Sedimentology and Stratigraphy, Merrill Publ.Co..
2. Miall, A.D., 1990, Principles of Sedimentary Basin Analysis, Springer Verlag
3. Reading, H.G. (Ed.), 1996, Sedimentary Environments and Facies, Blackwell Science2
4. Collinson, J., Mountney, N.,Thompson, D., Sedimentary Structures,Terra Publishing, 3rd Edn.,2006.
5. Nicholls, G.Sedimentology and Stratigraphy,Wiley-Blackwell,1999.
6. Prothero, D.R.and Schwab, F.Sedimentary Geology: An introduction to Sedimentary Rocks and Stratigraphy, 2nd Edn., W.H.Freeman,2003.
7. Selley, R.C., Applied sedimentology, 2nd Edn., Academic Press,2000.
8. Tucker, M.E. Sedimentary Petrology, 3rdEdn. Blackwell Science, 2001
9. Petroleum Geology by F.K. North, Publisher: Allen &Unwin
10. Elements of Petroleum Geology by R. C Selly. Publisher: Academic Press
11. Basic Petroleum Geology by P. K. Lint. Publisher: OGCI
12. Geology of Petroleum by A.I. Levorsen, Publisher: W.H. Freeman &co.
13. Petroleum Formation & Occurrence By- Tissot, B.P. &Welte, D.H. Publisher: Springer
14. Petroleum (Indian context) by D. Chandra & R.M. Singh. Publisher: Tara Book Agency, Varanasi

SUBJECT: PRINCIPLES OF SURVEYING AND REMOTE SENSING

PE-402-T

3L-0T-0P: 03Credits

1. Fundamental concepts: Introduction, definitions, surveying, classification of surveying, principles of surveying, errors.
2. Chain Surveying : Different methods, direct measurement, instruments for chaining, ranging out survey lines, chaining , measurement of length with the help of tape, error due to incorrect chain, chaining on uneven or sloping ground, errors in chaining, tape corrections.
3. Compass Traversing: Introduction, bearing and angles, the theory of magnetic compass, classification of compass, magnetic declination, local attraction, errors in compass survey, adjustments of closing errors.
4. Plane Table Surveying : General : Accessories, working operations, methods of plane tabling, two point problem and three point problem. Advantages and Disadvantages of plane table surveying.
5. Levelling: Different methods of levelling, curvature and refraction, reciprocal levelling. Difference of elevation – single observation, reciprocal observation.
6. Contouring: Definition, characteristics of contours. Use of contour maps, direct and indirect methods of contouring.
7. Measurement of area: area bounded by irregular boundaries- Mid ordinate rule, average ordinate rule, trapezoidal rule, Simpson's rule; area by double meridian distances, area by coordinates, planimeter.
8. Measurement of volume: measurement from cross-sections, prismoidal formula, trapezoidal formula, capacity of reservoir.
9. Electromagnetic-distance Measurements: Electromagnetic waves, modulation, types of EDM, total station.
10. Photographic surveying: Introduction, terrestrial and aerial photograph, horizontal position of a point from terrestrial photograph, horizontal and vertical angles from terrestrial photograph, focal length determination; scale of vertical photograph, computation of length and height from vertical photograph, relief displacement, scale of tilted photograph, tilt distortion, flight planning, stereoscopic vision, parallax in aerial photograph, measurement of parallax.
11. Remote sensing : Electromagnetic energy, electromagnetic spectrum, interaction of electromagnetic energy with matter, remote sensing sensor systems, platforms, ideal and

real remote sensing system, data acquisition and interpretation, application of remote sensing, remote sensing in India.

SUBJECT: PRINCIPLES OF SURVEYING AND REMOTE SENSING LAB

PE-402-P

0L-0T-1P: 01Credits

Chaining of a line using Chain/Tape/Tachometer and Recording of details along the chain line, Measurement of area – Cross staff survey, Traversing by compass and graphical adjustment, Determination of distance between two inaccessible points., Fly Leveling, Reciprocal leveling, Profile Leveling, Contouring, Plane Table Survey: Traversing, Resection by Trial and Error method, Measurement of horizontal and vertical angles, distance using Theodolite, measurement of horizontal and vertical distances, directions, elevations, computation of area, using Total Station, Setting of simple curve using tape or/and theodolite, Total Station, Setting

SUBJECT: PRODUCTION ENGINEERING –I

PE-403-P

3L-0T-0P: 03 Credits

- [1] Characteristics of crude oil and natural gas, classification of crude and its physicochemical properties.
- [2] Introduction to Productivity Index (PI) & Inflow Performance Relationship (IPR).
- [3] Well Completion: Importance of Well Completion, Well Completion Equipment, Well Completion Methods.
- [4] Well Perforation: Introduction, Well Perforating Methods, Perforating Gun Types, Shaped Charge, Type, Size, Depth and Orientation of perforation holes, Shot Density, Standoff, Explosives in perforation, Explosive Train.
- [5] Well activation: Importance of Well Activation, Well Activation methods viz. Displacement, Compressor Application, Application of Nitrogen, Aerisation, Swabbing etc.
- [6] Artificial Lift Technology: Basic principles and descriptions of Artificial Lift Methods, Continuous and Intermittent Flow Gas Lift, Design of Gas Lift System, Plunger Lift, Chamber Lift, Sucker Rod Pumping (SRP), Electrical Submersible Pumping (ESP), Hydraulic Pumping (HP).
- [7] Well Stimulation Techniques: Importance of Well Stimulation, Acid Solutions for Acidizing, Acid Additives, Matrix Acidizing, Fracture Acidizing, Hydraulic Fracturing, Wave Technology, Microbial Stimulation.

[8] Introduction to Well Servicing: Objectives and Applications, production problems.

Text Book References:

- [1] Principles of Oil Well Production- T. E. W. Nind.
- [2] Applied Petroleum Reservoir Engineering- Craft and Hawkins.
- [3] The Technology of Artificial Lift Methods, Volume 1- Kermit E. Brown.
- [4] Petroleum Engineering Handbook-Howard B. Bradley.
- [5] Oil and Gas Filed Development Techniques: Well Completion and Servicing- Denis Perrin, Michel Caron and Georges Gaillot.
- [6] Production Operations: Well Completions, Workover and Stimulation, Volume 1 - Thomas O. Allen and Alan P. Roberts.
- [7] Production Operations: Well Completions, Workover and Stimulation, Volume 2- Thomas O. Allen and Alan P. Roberts.
- [8] Dictionary of Petroleum Exploration, Drilling & Production- Norman J, Hyne.

SUBJECT: RESERVOIR ENGINEERING

PE-402

3L-0T-0P: 03 Credits

Unit I: Fundamentals of petroleum, petroleum reservoir, reservoir engineering, classification of petroleum reservoir.

Unit II: Reservoir rock properties: porosity, permeability, combination of permeability in parallel and series beds, porosity permeability relationship, effective and relative permeability, fluid saturation and significance, wettability, capillary pressure, surface tension /interfacial tension.

Unit III: Reservoir fluid properties, reservoir fluid sampling, PVT properties, different correlations and laboratory measurements, phase behavior of hydrocarbon system.

Unit IV: Reservoir drive mechanics and recovery factors, generalized MBE, drive indices, performance prediction of depletion, gas-cap, water and combination drive.

Unit V: Reserve estimation: Resource and reserve concept, estimation of petroleum reserves, latest reserves classification.

Text/Reference Books -

- [1] Reservoir Engineering Handbook- Tarek Ahmed
- [2] Advanced Reservoir Engineering- Tarek Ahmed, Paul D. Mcinney
- [3] Phase Behavior of Petroleum Reservoir Fluid- Pederson, Chrisgtensen
- [4] Estimation and Classification of Reserves of Crude oil, Natural Gas & Condensate- Chapman Corrnquist
- [5] Fundamental of Reservoir Engineering- L. P. Dake
- [6] Applied Petroleum Reservoir Engineering- Craft and Hawkins

SUBJECT: INSTRUMENTATION AND CONTROL SYSTEM

PE/ECE-401

3L-0T-0P: 03

Credits

UNIT I

Importance of measuring of Instruments in Process Control, Classification of Instruments, Elements of an Instruments, Static & Dynamic Characterization of Instruments, Errors in measurements & Error Analysis, Selection of instrument for a particular Measurement, transducers.

UNIT II

Measurement of Temperature: Thermocouples, Resistance Thermometer, Expansion Thermometers, Pyrometers.

Measurement of Pressure & Vacuum, Hydrostatic type, Elastic Element type, Electrical Type and other type of instruments like McLeod Gauge, Thermocouple gauge, Knudson Gauge, Ionization Gauge.

UNIT III

Instruments for Measurement of Flow rate & level: Variable Area & variable head flow meters, Volumetric and Mass flow rate meters, Linear velocity measurement systems, Anemometers, Pressure type, Resistance & Capacitance type, Sonic & Ultrasonic, Thermal type Level meters.

UNIT IV

Instruments for Measurement of Viscosity: Redwood, Saybolt, Engler, Cup & Cone type, Rheo & other types of viscometers.

UNIT V

Dynamic modeling of first and second-order process, Interacting and non-interacting processes, Nonlinear and integrating processes, Classification of controllers and control strategy, types of control: P, PI, PD and PID

Books:

1. Eckman, D.P., Industrial Instrumentation, Wiley Eastern Ltd., New York 1990.
2. Jain, R.K., Mechanical and Industrial Measurements, Khanna Publishers.
3. Coughnaowr, D. R., "Process Systems Analysis and Control", McGraw-Hill, Inc.
4. Stephanopolous, G., "Chemical Process Control", Prentice-Hall.

SUBJECT: TECHNICAL ENGLISH

HSMC-401 2L-0T-0P: 02 Credits

- [1] Communication skills (What is communication skills? Necessity of skills in the corporate sector, the flows of communication, Barriers of communication, LSRW skills, Verbal and non-verbal communication)
- [2] Workplace etiquette (Team management, Grooming and dress code, How to address people in the corporate sectors, Mock interviews, Problem solving aptitude and handling conflicts, Management of time in a corporate sector-notes making)
- [3] Job Interviews (Pre-interview preparation techniques, Resume writing, Practice through mock interviews and group discussions, Problem solving and practicing through potential interview questions)
- [4] Presentation Skills (How to make an effective power point presentation, Breaking down Laskowski's acronym on 'AUDIENCE' in a presentation, Techniques of organising

materials and points in a seminar report, Actual practice of presenting a report and evaluation)

- [5] Group Discussion (GD)- (Relevance and purpose of group discussion, mechanism of group discussion, Importance of subject knowledge in a GD, Range of topics in a GD and Strategies for an effective GD)
- [6] Business Writing (How to make business drafts, e-mails by avoiding mistakes in grammar, punctuation, spelling, wordiness and jargons; how to make technical reports and business letters effectively)
- [7] English Pronunciation and conversation (Role playing, Practicing through GDs and mock interviews, Reading aloud, Critical reviewing of a current topic orally)
- [8] Vocabulary Test (Prefixes, Suffixes, Homonyms, Homophones, Synonyms, Antonyms, Words often confused, One word substitution, Foreign terms and expressions, Idioms and phrases, Abbreviations and acronyms)

Reference Books:

- [1] Effective Technical Communication: M. Ashraf Rizvi; Tata McGraw Hills.
- [2] Professional Communication Skills: A.K.Jain, PrabirS.R.Bhatia; S.Chand and Co.
- [3] Communicative English for Engineers and Professionals: NitinBhatnagar&MamtaBhatnagar; Pearson Education ltd.
- [4] A Communicative Grammar of English: Leech, Geoffrey &Svartvik; Pearson

COURSE CONTENT

5th SEMESTER

SUBJECT: MANAGERIAL ECONOMICS AND ACCOUNTANCY

HSMC-501

2L-1T-0P: 03 Credits

1. Nature, scope and methods of managerial economics.
2. Managerial Economic Concepts – Incremental concept; Opportunity Cost concept; Equi-marginal concept; discounting concept; Risk & Uncertainty.
3. Law of Diminishing Marginal Utility.
4. Demand Analysis – Meaning & type; Law of Demand – features; Exceptions; Market Demand Schedule & Curve; Elasticity of Demand – Price elasticity, cross elasticity & income elasticity.
5. Indifference Curve approach and its properties.
6. Supply – its law, elasticity & curve.
7. Types of markets; Pricing under various market conditions – Perfect competition, imperfect competition & monopolistic competition.
8. Profit & Profit measurement.
9. Inflation – meaning; Demand-pull, cost-push inflation; Inflationary gap; Causes and steps to control inflation.
10. National Income – Concepts & methods of measurement; Difficulties in measuring national income.
11. Nature, scope and methods of managerial economics.
12. Managerial Economic Concepts – Incremental concept; Opportunity Cost concept; Equi-marginal concept; discounting concept; Risk & Uncertainty.
13. Law of Diminishing Marginal Utility.
14. Demand Analysis – Meaning & type; Law of Demand – features; Exceptions; Market Demand Schedule & Curve; Elasticity of Demand – Price elasticity, cross elasticity & income elasticity
15. Indifference Curve approach and its properties.
16. Supply – its law, elasticity & curve.
17. Types of markets; Pricing under various market conditions – Perfect competition, imperfect competition & monopolistic competition.
18. Profit & Profit measurement.
19. Inflation – meaning; Demand-pull, cost-push inflation; Inflationary gap; Causes and steps to control inflation.

20. National Income – Concepts & methods of measurement; Difficulties in measuring national income.

Text Book References-

1. Managerial Economics by William F. Samuelson and Stephen G. Marks
2. Managerial Economics: Theory, Applications, and Cases by W. Bruce Allen, Keith Weigelt, Neil Doherty and Edwin Mansfield
3. Managerial Economics by Christopher Thomas and S. Charles Maurice
4. Managerial Economics by William F. Samuelson and Stephen G. Marks
5. Managerial Economics: Theory, Applications, and Cases by W. Bruce Allen, Keith Weigelt, Neil Doherty and Edwin Mansfield
6. Managerial Economics by Christopher Thomas and S. Charles Maurice

SUBJECT: PRODUCTION ENGINEERING –II

PE-501-T

2L-1T-0P: 03 Credits

1. Well Performance: Productivity Index (PI), Specific Productivity Index, Importance of Inflow Performance Relationship (IPR), Vertical Lift Performance, Bean Performance, Multiphase Flow in tubing and flow lines, Coning, Production Optimization– Nodal System analysis, Production Logging.
2. Sand Control: Sand Control Techniques, use of Screens, Gravel Packing, Formation Sand size analysis, optimum Gravel-Sand Ratio, Gravel Pack Thickness, Gravel Selection, Gravel Packing Fluid, Gravel Placement Techniques, Chemical Method of Sand Control.
3. Oil and Gas Processing: Introduction to Oil & Gas Separation, Flash & Differential Separation, Stage Separation, Fluid Level and Pressure Control System, FWKO, Two Phase Separator, Three Phase Separator; Horizontal, Vertical, Spherical and Centrifugal Separator, Scrubber, Treater, Wash Tank, Design of Oil & Gas Separator, Safety Feature in separators, Sand Removal, Desalting, Gas Dehydration, Gas Sweetening, formation of Gas Hydrates.
4. Crude Oil Storage Tank: Types & Features of Storage Tanks, Tank Accessories, Tank Batteries, Metering of Oil & Gas, Sampling of Crude Oil, Gauging Equipment and Methods, Vapor Recovery System.

5. **Application of AI and ML in Production Engineering and Well Completion:** Role of Machine Learning in Production Engineering; Production Optimization; Well's Potential; Production Rates for Gas-lift Wells; Poor Well Performance; Critical Oil Rate.

Text Book References:

1. Principles of Oil Well Production- T. E. W. Nind.
2. Introduction to Petroleum Production, Volume I- D. R. Skinner.
3. Introduction to Petroleum Production, Volume-II- D. R. Skinner.
4. Gas-Liquid and Liquid-Liquid Separators- Maurice Stewart and Ken Arnold.
5. Oilfield Processing, Volume Two: Crude Oil- Francis S. Manning and Richard E. Thompson.
6. Petroleum and Gas Field Processing- H. K. Abdel-Aal, Mohamed Aggour and M. A. Fahim.
7. Petroleum Engineering Handbook-Howard B. Bradley.
8. Introduction to Oil and Gas Production, Vocational Training Series- American Petroleum Institute.

SUBJECT:PRODUCTION ENGINEERING LABORATORY

PE-501-P

0L-0T-1P: 01 Credits

1. To Identify and study of Casing, Float Collar, Casing Shoe, Casing Head Spool, Casing Valve, Gauge Cutter.
2. To Identify and study of Packer, Cross over Sub, Side Pocket Mandrel, Sliding Valve.
3. To Identify and study of Scraper, Fishing Tool, Shock Sub, Change over Sub, Centralizer, Slick Line, Wire Rope, Piano Wire.
4. To Identify and study of Tubing Hanger, Hanger Flange, Elevator, Sleeve, Ring Seal, Coupling, Dognut.
5. To Identify and study of Bean Housing, Gate Valve, Casing Valve, Standing Valve, Needle Valve, Bean Nozzle, Bean Wrench, Pressure Gauge.

SUBJECT: ADVANCED RESERVOIR ENGINEERING

PE-502-T

3L-0T-0P: 03 Credits

- Unit I:** Flow of Fluids through Porous Media: Darcy's law, assumptions and applications, single and multiphase flow, Types of fluid- compressible fluid, incompressible and slightly compressible fluid; radial and spherical flow, steady state and unsteady state flow.
- Unit II:** Productivity Index, Injectivity Index, Formation Damage, Skin Effect, GOR, WOR equations, principles of fluid flow for steady state, semi steady state and unsteady state conditions.
- Unit III:** Water influx in reservoir, different water influx models.
- Unit IV:** Water and gas coning; Immiscible displacement process, Buckley and Leverett treatment of fractional flow and frontal advance equations.
- Unit V:** Reservoir Management: Concepts of Reservoir Management and its Application
- Unit VI:** Application of AI and ML in Reservoir Engineering: Role of Machine Learning in Reservoir Engineering; EOR; Well Testing; Decline Curve Analysis; Equations and Descriptions.

Text/Reference Books -

1. Reservoir Engineering Handbook- Tarek Ahmed
2. Advanced Reservoir Engineering- Tarek Ahmed, Paul D. Mcinney
3. Fundamental of Reservoir Engineering- L. P. Dake
4. Applied Petroleum Reservoir Engineering- Craft and Hawkins
9. Basics of Reservoir Engineering- R Cosse

SUBJECT: RESERVOIR ENGINEERING LABORATORY

PE-502-P

0L-0T-1P: 01 Credit

1. To prepare the core samples from conventional core/outcrops in desired shape, size and smoothness.
1. To clean the given Core Samples using Soxhlet Apparatus.
2. To clean the given Core Samples using Ultrasonic Cleaner.

3. To determine the dryness fraction of core samples in Humidity Cabinet.
4. To determine the Porosity of given Core Samples using Helium Porosimeter.
5. To determine / estimate the the Gas Permeability and Liquid Permeability/Absolute Permeability using Gas Permeameter.

SUBJECT: RESERVOIR MODELING AND SIMULATION

PE-503

3L-0T-0P: 03 Credits

Reservoir Modeling:

Introduction to general modeling: Introduction to concept geological modeling. Types of model and designing of various models depending on reservoir complexities, rock properties, fluid properties.

Reservoir Simulation:

1. Overview: Introduction, Historical background, application of simulator, various types of models.
2. Flow Conditions: Single phase flow equations for one, two and three dimension models.
3. Special Concept: Explicit and implicit, grid system, finite difference & finite element method, matrix solution, stability criteria.
4. Data Preparation
5. Pesudofunctions
6. Reservoir model Solution Techniques: Implicit Pressure and Explicit Saturation (IMPES)
7. Preview of numerical solution methods: Direct process, iterative process.
8. History Matching: Mechanics and parameters of match
9. Special Concept on Coning and Compositional Models simulation.
10. Optimization using Economic evaluation
11. Introduction to streamline simulation & comparison of conventional/Streamline simulation.

Text Book References-

1. Principles of Applied Reservoir Simulation, by John R. Fanchi

2. Advanced Petroleum Reservoir Simulation by Rafiq Islam, S.H. Moussavizadegan, ShabbirMustafiz and Jamal H. Abou-Kassem
3. Practical Enhanced Reservoir Engineering: Assisted with Simulation Software by AbdusSatter, Ghulam M. Iqbal and James L. Buchwalter
4. Practical Reservoir Simulation by M. R. Carlson
5. Modern Reservoir Engineering: A Simulation Approach by Henry B. Crichlow

SUBJECT: DESIGNS OF DRILLING ENGINEERING

PE-CElv.-501-1

2L-1T-0P:03 Credits

A. Drilling Fluids and its design:

1. Overview of Drilling Fluids: Clay chemistry and its application to drilling fluids, Types of clays, hydration, flocculation, aggregation and dispersion.
2. Classification, Types and applications of Drilling Fluids: Water based, oil based, emulsion based, polymer based, Surfactant based, Foam based and Aerated drilling fluids.
3. Drilling Fluid Characteristics: Basic functions, properties, maintenance and treatments of drilling fluids.
4. Drilling fluid design and casing design.

B. Cements:

1. Cementing, Cements & cement slurry: Objectives of cementing, oil well cements, Classification of cement, Slurry additives, Factors influencing cement slurry and its design, Cementing equipment.
2. Cementing Methods: Primary cementing, Stage cementing, Liner cementing, Plugging, Squeeze Cementing techniques in practice. Characteristics of good quality cementation.
3. Cement slurry design and volume calculations

SUBJECT: WELL CONTROL SYSTEMS

PE-CEIv.-501-2

2L-1T-0P: 03 Credits

1. Basic terms, BHP and leak off test.
Kick, Blow Out, Primary, Secondary & Tertiary Well Control, Bottom Hole pressure, Normal & Abnormal Formation pressure, Causes of abnormal pressure, U tube concept, swab and Surge effects, Equivalent Circulating Density.
2. Kick Indications & Shut-In Procedure
Causes of Kick, Early warning signs, positive kick signs, Shut-in procedures, Type of Influx and behaviour, Gas influx behaviour.
3. Well Killing Methods
Drillers method, wait & weight Method, Volumetric Method, Comparison of methods and calculations, Stripping and Snubbing.
4. Blow Out Preventer Equipment
Annular preventer and packing Elements, Pipe ram, Blind ram and variable Bore ram Preventer, Koomey unit, Choke & kill Manifold, Diverters, Trip tank, Mud gas separator, Vacuum degasser, Pit volume recorder, Mud flow indicators, BOP drill.

SUBJECT: PETROCHEMICALS

PE-CEIv.-502-1

3L-0T-0P: 03 Credits

Unit1:

Petrochemicals

- a. History and growth of petrochemical industry.
- b. Petrochemical industries in India
- c. Trends in Petrochemical Industries
- d. Petrochemicals from Natural Gas: Methane, ethane, propane and butane based Petrochemicals.

Unit-2:

Raw materials

- a. Crude oil and natural gas as raw materials for petrochemical industries, Individual hydrocarbons and Petroleum cuts as feed stock for petrochemical manufacture.
- b. Manufacture of petrochemical feedstock, such as ethylene, propylene, BTX and synthesis gas for manufacture of ammonia and methanol.
- c. Separation process used for purification of product gases of a gas cracker.

d. Petrochemical Feed Stocks: Aromatics, un-saturates and saturates (linear and cyclic).

Unit-3:

Polymerization

- a. Basic concept of polymer chemistry, the type and structure of the macromolecular products, Physical and mechanical properties of high molecular mass compounds.
- b. Classification of polymers according to the Gas Cracker Products.

Unit-4:

Oxidation

- a. Basic reactions and mechanisms in the oxidation of hydrocarbons.
- b. Process for oxidation of light olefins, production of ethylene oxide, acetaldehyde, acrylonitrile etc.

Unit-5:

Manufacture of petrochemicals

- a. Hydration of Olefins, basic concepts concerning hydration of olefins.
- b. Direct and indirect ways of olefins hydration.
- c. Manufacture of low molecular weight alcohols from olefins.
- d. Processes used in sulfuric acid as a means of obtaining a under molecular weight range of alcohols.

Unit-6:

Processes for Petrochemical Manufacture

- a. Ammonia and methanol synthesis, OXO synthesis.
- b. Manufacture of some important commercial polymer products.

Unit-7:

Petroleum Product safety & Transportation

- a. Product Handling & Safety: Loss Prevention, underground storage, Product Blending.
- b. Transport and distribution, Fire Prevention & safety devices.

Text/Reference Books -

1. Petrochemical Processes- A.Chuvel, G. Lefebure
2. Petrochemicals- DjebbarTiab, Erle C, Donaldson
3. Petrochemical Technology Assessment- John Wiley
4. Petrochemicals – B. K. Bhaskar Rao

SUBJECT: UNIT OPERATIONS

PE-CElv.-502-2

3L-0T-0P: 03 Credits

Unit-1:

Definitions and Principles

Physical quantities, Gas constants, Engineering units, Conversion of units, Units and equations, Equation of states (EOS),

Unit-2:

Compressible and incompressible fluid flow

Basics of laminar and turbulent flow, Reynold number, flow of compressible and incompressible fluid in conduits, laminar flow in pipes, Bernaulis equation, NavierStoke's equation, turbulent flow in pipes and closed conduits, incompressible fluid flow in closed channels, Compressible fluid flow through variable-area conduits, Adiabatic and isothermal fluid flow, Fluidization, Motion of particles through fluids.

Unit-3:

Transporting and Metering of Fluids

Different fluid moving machinery, Pipes, tubes, fittings and valves, Positive displacement machinery, Centrifugal pumps and compression principles, Hydrostatic equilibrium equation, Barometric equation, Principles of U-Tube Manometer, Inclined manometer, Insertion meter, Full bore meter.

Unit-4:

Heat Transfer in fluid flow

Energy balance, Mode of heat transfer, Steady and Un steady state heat transfer, Rate of heat transfer, Heat transfer by forced convection in laminar/turbulent flow, Heat transfer in transition region between laminar and turbulent flow, Prandtl number, Nusselt number, Overall heat transfer coefficient.

Unit-5:

Gas absorption and adsorption

Principles of gas absorption and adsorption, Equilibria adsorption isotherms, Basic equation for absorption and adsorption, Mass transfer equations, Absorber/adsorber design, Design of Packed tower, Raschig rings, Mass Transfer Correlations, Plate column, Absorption with chemical reactions.

SUBJECT: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

PE/CSE-501

3L-0T-0P: 03Credits

Course Content:

UNIT I INTRODUCTION TO AI AND PRODUCTION SYSTEMS

Introduction to AI-Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics - Specialized production system- Problem solving methods - Problem graphs, Matching, Indexing and Heuristic functions -Hill Climbing-Depth first and Breadth first, Constraints satisfaction - Related algorithms, Measure of performance and analysis of search algorithms.

UNIT II REPRESENTATION OF KNOWLEDGE

Game playing - Knowledge representation, Knowledge representation using Predicate logic, Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic-Structured representation of knowledge.

UNIT III KNOWLEDGE INFERENCE

Knowledge representation -Production based system, Frame based system. Inference - Backward chaining, Forward chaining, Rule value approach, Fuzzy reasoning - Certainty factors, Bayesian Theory-Bayesian Network-Dempster - Shafer theory.

UNIT IV PLANNING AND MACHINE LEARNING

Basic plan generation systems - Strips -Advanced plan generation systems – K strips -Strategic explanations -Why, Why not and how explanations. Learning- Machine learning, adaptive Learning.

UNIT V EXPERT SYSTEMS

Expert systems - Architecture of expert systems, Roles of expert systems - Knowledge Acquisition – Meta knowledge, Heuristics. Typical expert systems - MYCIN, DART, XOON, Expert systems shells.

Course Content:

Module – 1

Introduction: Well posed learning problems, designing a Learning system, Perspective and Issues in Machine Learning.

Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias.

Text Book1, Sections: 1.1 – 1.3, 2.1-2.5, 2.7

Module – 2

Decision Tree Learning: Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.

Text Book1, Sections: 3.1-3.7 Module – 3

Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptrons, Backpropagation algorithm.

Text book 1, Sections: 4.1 – 4.6

Module – 4

Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm

Text book 1, Sections: 6.1 – 6.6, 6.9, 6.11, 6.12

Module – 5

Evaluating Hypothesis: Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms.

Instance Based Learning: Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, case-based reasoning,

Reinforcement Learning: Introduction, Learning Task, Q Learning

Course outcomes: The students should be able to:

- Identify the AI based problems
- Apply techniques to solve the AI problems
- Define learning and explain various learning techniques
- Discuss expert systems

After studying Machine Learning course, students will be able to

- Recall the problems for machine learning. And select the either supervised, unsupervised or reinforcement learning.
- Understand theory of probability and statistics related to machine learning
- Illustrate concept learning, ANN, Bayes classifier, k nearest neighbor, Q,

Texts/Reference:

1. Russel & Norvig: Artificial Intelligence a Modern Approach; Pearson
2. Rich and Knight: Artificial Intelligence; TMH.
2. N. J. Nilson: Principles of Artificial Intelligence; Narosa.
3. P. Norvig : Paradigms of AI programming; Elsevier.
4. Brakto: Prolog Programming; Pearson

Text Books for Machine Learning:

- Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.
[Text book Sections: 5.1-5.6, 8.1-8.5, 13.1-13.3]

Reference Books for Machine Learning:

- □ Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.
- □ EthemAlpaydın, Introduction to machine learning, second edition, MIT press.

COURSE CONTENT

6TH SEMESTER

SUBJECT: PRINCIPLES OF WATER FLOODING (OPEN ELECTIVE-II)

PE-OElv.-601

3L-0T-0P:03Credits

1. Introduction to Water flooding: Formation Energy, Pressure Maintenance, Importance of Water flooding, Optimum Time to Water flood, Effect of Trapped Gas on Water flood Recovery, Factors affecting Water flood Performance, Displacement Efficiency, Sweep Efficiency, Recovery Efficiency, Infill Drilling, Cutler's Law, Reservoir Heterogeneity, Methods used to characterize Vertical Permeability Stratifications, Mobility & Mobility Ratio, Low salinity water flooding.

2. Water flood Patterns: Importance of Pattern Water flooding, Types of Flood Patterns.

3. Fractional Flow Curve: Importance of Fractional Flow Equation, Fractional Flow Curve, Types of Fractional Flow Curves, Effects of Wettability, Viscosity, Dip Angle, Capillary Pressure etc. on Fractional Flow Curve.

4. Frontal Advance Equation: Importance of Frontal Advance Equation, Stabilized and Non stabilized Zone, Shock Front, Water Breakthrough, Water Saturation Profile, Oil Recovery Calculation.

5. Injection Water Treatment: Treatment Objectives, Injectivity Problems, Sources of Injection Water, Desired Characteristics of Injection Water, Design consideration for Water Handling and Injection System.

6. Oil & Gas Field Development: Development of Oil & Gas Fields, Rate and Order of drilling well, well spacing & pattern.

Text Book References:

1. Reservoir Engineering Handbook- Tarek Ahmed.
2. The Reservoir Engineering Aspects of Waterflooding- Forrest F. Craig, Jr.
3. The Design Engineering Aspects of Waterflooding- Stephen C. Rose, John F. Buckwalter and Robert J. Woodhall.
4. Waterflooding- James T. Smith and William M. Cobb.

SUBJECT: PETROLEUM EXPLORATION – I

PE-CEIv.-601-1

3L-0T-0P: 03Credits

1. Surface indications of subsurface oil and gas accumulations.
2. Oil accumulation parameters.
3. Time of accumulation vis-avis time of oil generation.
4. Exploration Philosophy and Principles. Stages and norms of exploration.
5. Geological techniques and procedures of petroleum exploration. Geological mapping
6. Geochemical methods of prospecting: Soil geochemical surveys; Hydro-geochemistry as a tool for oil exploration.
7. Source rock types, Kerogen types, maturation & significance, Source rock characterization: Rock Eval Pyrolysis, Vitrinite Reflectance, Thermal Alteration Index (TAI), Total Organic Carbon (TOC), Carbon Ratio Method
8. Development Geology
9. Role of plate tectonics in Hydrocarbon accumulation onshore and offshore.
10. Application of AI and ML in Geosciences

TEXT/REFERENCE BOOKS:

1. Theoretical Principles of Exploration and Development of Oil & Gas Accumulation by Bakirov,A.D
2. Handbook for Prospectors by Richard M.Peaut
3. Petroleum Exploration Handbook by Moody,GB.
4. Development and Exploration of Oil and Gas Fields by Peace Publishers, Moscow
5. New technologies for Exploration & Development of Oil and Gas Resources by Graham &Trotman
6. Petroleum Exploration and Exploitation Practices by BhagwanSahay
7. Petroleum Source Rocks by Barry Katz
8. New Technologies for the Exploration and Exploitation of Oil and Gas resources by Miller,Joulia Asselt&Angyris

SUBJECT: MICROPALAEONTOLOGY IN FOSSIL FUEL INDUSTRY

PE-CEIv.-601-2

3L-0T-0P: 03Credits

1. Introduction to micropaleontology, classification of microfossils
2. Introduction to different microfossils such as - foraminifera, calcareous nannofossils, palynomorphs, siliceous microfossils - radiolaria and diatoms.
3. Morphology, classification, evolution and geological distribution of important microfossil groups. Stratigraphic significance of different microfossils with special reference to India, Important Microfossils from NE India.
4. Concept of biostratigraphy, Concept of palynofacies and its application in paleoenvironment interpretation and fossil fuel industry.
5. Application of micropalaeontology to hydrocarbon exploration, appraisal and field development studies, assessment of reservoir trap evaluation and source rock evaluation

TEXT/REFERENCE BOOKS:

1. Micropaleontology (2016). Pratul Kumar Sarawati & M. S. Srinivasan.

2. Introduction to Marine Micropaleontology. B.U. Haq, and A. Boersma, (eds.). 1978.. Elsevier, New York. 376 pp.
3. Micropalaeontology in Petroleum Exploration: Robert Wynn Jones, Oxford Science Publication
4. Palaeontology – An Introduction: E. W. Nield and V. C. T. Tucker, Pergamon Press
5. Applied Micropalaeontology: Ed. David Graham Jenkins, Kluwer Academic publishers

SUBJECT: ADVANCED DRILLING ENGINEERING

PE-602

3L-0T-0P: 03Credits

1. Directional Drilling: Objectives, Types of deflection tools, tool orientation, Directional well profiles.
2. Well Monitoring: Well path deflection & correction. Down the hole surveying methods, Surveying Analysis Methods and Calculations of Three Dimensional well coordinates.
3. Surveying Tools: Single shot and multi shot survey tool, MWD & LWD tools, Telemetry system.
4. Down Hole Motors: Positive displacement motors and Turbo-drills - motor description, Power calculation and applications. Rotary Steerable system, Geo-steering tools.
5. Horizontal Well Drilling: Horizontal well objectives and selection, Different profiles, Drilling techniques etc.
6. Special Methods of Directional Drilling: Extended reach drilling, Multilateral drilling, coil tubing drilling, UBD, MPD.
7. Hole cleaning in high angled wells.

SUBJECT: NATURAL GAS ENGINEERING

PE-603

3L-0T-0P: 03Credits

1. Gas from condensate and oilfields. Scope of Natural gas industry. Basic thermodynamic and system energy concepts in Natural Gas Engineering.
2. Physical properties of natural gas and hydrocarbon liquids associated with Natural gas. Reservoir aspects of natural gas.

3. Flow of fluids. Compression calculations. Heat Transfer and Mass Transfer principles and applications in Natural Gas Engineering.
4. Gas flow measurement. Process control and instrumentation in natural gas processing plants.
5. Natural Gas Processing. Field separation and oil absorption process. Refrigeration and low temperature processing. Liquefaction Process. Dehydration of Natural Gas sweetening of Natural gas and sulphur recovery, Processing for LPG, LNG, CBG, CNG, system.
6. Transmission of Natural Gas. Specifications. Utilization of Natural Gas. Underground storage and conservation of Natural Gas.
7. Unconventional gas: Coal Bed Methane, Natural Gas Hydrate. Insitu Coal Gasification.
8. Conversion of gas to liquid.
9. Hydrogen Energy
 - a. Basics of hydrogen properties and its energy
 - b. Hydrogen as a renewable energy source
 - c. Introduction to fuel cell
 - d. Hydrogen as green fuel
 - e. Hydrogen energy to fuel cell
 - f. Hydrogen economy
 - g. Hydrogen storage

Text/Reference Books –

1. Natural Gas: A Basic Handbook by J. G. Speight
2. Handbook of Natural Gas Transmission and Processing by Saeid Mokhatab, William A. Poe and James G. Speight
3. Natural Gas Engineering Handbook by Boyun Guo and Ali Ghalambor
4. Advanced Natural Gas Engineering by Michael Economides and Xiuli Wang
5. Standard Handbook of Petroleum and Natural Gas Engineering: Volume 1 & 2, (by William C. Lyons Ph.D. P.E)
6. Working Guide to Petroleum and Natural Gas Production Engineering by William C. Lyons.

SUBJECT: ENHANCED OIL RECOVERY

PE-CEIv.-602-1- T

3L-0T-0P: 03 Credits

- Unit I:** Introduction to EOR, Basic principles and mechanism of EOR, Mobility ratio concepts, Screening of EOR processes.
- Unit II:** Chemical Flooding: Polymer flooding, Surfactant flooding, Caustic flooding; ASP flooding – Principles and applications.
- Unit III:** Miscible Flooding: First contact miscibility, Multiple Contact Miscibility-Condensing Gas Drive, Vaporizing Gas Drive, Principles and applications of CO₂ flooding.
- Unit IV:** Thermal Recovery Techniques - Steam stimulation, hot water flooding, steam flooding and in-situ combustion process.
- Unit V:** Microbial EOR - Principles and Applications; Introduction to Nano-technology based EOR.aspects

SUBJECT: NET ZERO CARBON STRATEGIES INTEGRATION

PE-CEIv.-602-2

3L-0T-0P: 03 Credits

1. Introduction: Scope, Objectives and Necessity of CCS
2. The contribution of fossil fuels emission to Climate change and global warming. Concept of Carbon Credit and carbon footprint.
3. Introduce a dedicated course on net-zero carbon methods and technologies, with a focus on carbon capture, utilization, and storage (CCUS)
4. Carbon capture techniques: Carbon-di-oxide emission, Scrubbing of CO₂, Carbon dioxide recycling

5. Carbon dioxide sequestration: Underground storage, Potential for Geologic Storage, Application in Oil and gas industry, Carbon dioxide flooding projects, Methane recovery projects. Emphasize the role of petroleum engineers in achieving sustainable energy solutions.
6. Strategy for implementing CCS technology.
7. Modeling of Cost and Performance of CCS Plants.
8. Role and function of IPCC

Text/Reference Books -

1. Carbon Capture and Storage by Steve Rackley.
2. Carbon Capture , Storage and utilization
3. Carbon Capture by Howard J.Hezog
4. Carbon Capture and Storage by Michale Faure

SUBJECT: RESERVOIR GEOMECHANICS

PE- 602-3

3L-0T-0P: 03 Credits

•Physico-mechanical properties of rocks; Elastic and time dependent behavior; Constitutive

Equations; Elastic moduli; Poroelasticity; Biot's poroelastic theory for static properties the effective stress concepts.

•Geological aspects of rock mechanics, Rock mass classification; Theories of rock failure; Elasticity failure mechanics, Compressive strength criteria, shear failure – Mohr Coulomb criterion, Failure criteria based on intermediate stress, Stress analysis; In situ stresses and stress distribution around openings; Stresses around borehole: general linear elastic solution, pyroclastic formation; Borehole failure criteria.

•Reservoir Compaction: Subsidence and well problems; Stress change in depleting reservoir, Consolidation theory.

Text and Reference Book:

1. Reservoir Geomechanics by Mark Zobac, Cambridge University Press, 2007.

SUBJECT: EOR LAB

PE-CElv.-602-1-P

0L-0T-1P:01Credits

1. To determine the Interfacial Tension of a given fluid.
2. To determine the Capillary Pressure of a given fluid.
3. To determine the Liquid Permeability of a given fluid in a given core sample.
4. To determine the Relative Permeability of Oil-Water system in a given core sample.
5. To determine the saturation of a given fluid in a given core sample.

SUBJECT: PIPELINE ENGINEERING

PE-604

2L-1T-0P: 03Credits

1. Transportation of petroleum & petroleum products.
2. Basics of pipeline construction, operation and protection.
3. Pump and compressor stations. Instrumentation and control.
4. Metering and measurements of oil and gas.
5. Traffic management, Fire and safety rules.
6. Indian and Global supply scenario of petroleum and petroleum products.
7. Storage of petroleum products in fixed installations. Standards and regulations.
8. Role of International oil companies and OPEC pricing mechanism.

Pipeline engineering

1. Objective and scope of pipeline as a means of fluid transportation with special reference to crude oil/gas/refined products, Economics of Pipeline transportation.
2. Design of Pipeline
3. Theory and different formulae of the flow of fluids in oil/gas pipelines; of different flow equations for laminar and turbulent flow of compressible and incompressible fluids (Newtonian); Introduction to the flow of Non-Newtonian fluids through pipes; multiphase flow and loop pipelines.

4. Construction of pipelines; materials; general equipment specifications (Pipes, valves and fittings); Pigging, Pigging Technology: pig launcher and receiver, types of pigs.
5. Corrosion protection and control; Design of cathodic protection system, Pipeline automation.
6. Offshore Pipeline: Description of stinger; and Riser, construction of offshore pipeline, Method of underwater welding.
7. Hydrates, wax & scale - formation and prevention. Crude conditioning and use of additives to improve flow conditions.

Text Book References-

1. Petroleum marketing practices and problems by William H. Day
2. Petroleum Transportation Handbook, By: Harold Sill Bell
3. The economics of petroleum, Author: Joseph Ezekiel Pogue
4. Fundamentals of Pipeline Engineering By Jacques Vincent-Genod
5. Pipeline engineering by Henry Liu
6. Petroleum Engineering Handbook, Vol. 3

SUBJECT: CONSTITUTION OF INDIA (AUDIT COURSE)

HSMC-601

0L-0T-0P: 0Credits

1. The History of the Making of Indian Constitution.
2. Preamble and the Basic Structures.
3. Fundamental Rights and Duties.
4. Directive Principles of State Policy.
5. Legislature, Executive and Judiciary.
6. Emergency Powers.
7. Special Provisions for Jammu and Kashmir, Nagaland and Other Regions.
8. Amendments.

Text/Reference Books –

1. D DBasu, Introduction to the Constitution of India, 20th Edn., LexisnexisButterworths, 2012.
2. Rajeev Bhargava (ed), Ethics and Politics of the Indian Constitution, Oxford University Press, New Delhi, 2008.
3. Granville Austin, The Indian Constitution: Cornerstone of a Nation, Oxford University Press, Oxford, 1966.
4. Zoya Hassan, E. Sridharan and R. Sudarshan (eds), India's Living Constitution: Ideas, Practices, Controversies, Permanent Black, New Delhi, 2002.
5. Subhash C. Kashyap, Our Constitution, National Book Trust, New Delhi, 2011.

**COURSE CONTENT
7th SEMESTER**

SUBJECT: OIL AND GAS WELL TESTING

PE- 701

3L-0T-0P: 03Credits

Unit I: Introduction to Oil and Gas Well Testing, Steady State and Unsteady Flow Tests, Diffusivity Equation, its derivation and Solution, Reservoir Pressure Measurements and Significance: Techniques of pressure measurement, Wellbore storage effects, Radius of investigation, Principle of Superposition.

Unit II: Oil Well Testing: Pressure Transient Tests: Draw-down and Buildup test analysis, Horner's approximation.

Unit III: Gas Well Testing: Flow after flow testing, Isochronal testing, Modified Isochronal testing

Unit IV: Injection well testing, Multiple well testing, Interference testing, Pulse Testing, Pressure fall-off test in injection wells, Multilayer reservoirs.

Unit V: Type curves and its uses, well test analysis by use of Type curves, Drill Stem Testing: Equipment, DST chart observation and preliminary interpretation, Pressure derivative curve.

Text/Reference Books -

1. Pressure Transient Test- SPE
2. Well Testing- John Lee
3. Pressure Buildup and Flow Tests in Wells – C. S. Matthews and D. G. Russell
4. Advances in Well Test Analysis – Robert C. Earlougher

SUBJECT: PETROLEUM EXPLORATION – II (OPEN ELECTIVE-IV)

PE-OEIV.-701

3L-0T-0P: 03Credits

1. An overview of Exploration Geophysics: Geophysics as an exploration tool, brief accounts of different geophysical exploration methods
2. Gravity Survey Method: Salient features of Earth's gravitational field in relation to gravity exploration, Units of gravity, Gravity measuring instruments, Gravity anomalies, Gravity data reduction, Drift, Latitude, Elevation and Free-air correction. Bouguer anomalies, Concept of isostasy, Gravity anomaly maps. Gravity response of simple geometric shapes, Airborne gravity survey, Interpretation of gravity anomalies and application of gravity methods.
3. Magnetic Survey Method: The geomagnetic field, Types of magnetism, Magnetic anomalies. Magnetic survey instruments, Field method of magnetic surveys. Reduction of magnetic data, diurnal and geomagnetic correction, Magnetic response from buried magnetic bodies, Airborne magnetic survey, Interpretation of magnetic anomalies, Application of magnetic survey.
3. Basic concepts of Seismic Methods: Types of seismic waves, Properties of seismic waves, Effects of the medium on wave propagation, Field surveys arrangements. Seismic recording instruments and energy source. Types of seismic noise.
4. Different aspects of reflection and refraction seismic survey, Importance of seismic reflection survey over seismic refraction survey technique. Types of Spread, Selection of field parameters, Basics of 2D, 3D and 4D seismic data acquisition, seismic data processing, Vertical Seismic Profiling (VSP), Applications of seismic method in oil exploration.

References:

1. Geophysical Prospecting by DobrinMiltonB.

2. Handbook for Prospectors by Richard M. Peaut
3. Petroleum Exploration Handbook by Moody, GB.
4. Handbook of Subsurface Geology by Moore, C.A
5. Electrical methods in Geophysical Prospecting by George V. Keller
6. New Technology in Exploration Geophysics, by H. Roices Nelson Jr.
7. Outlines of Geophysical prospecting by Ramchandra Rao

SUBJECT: CORE ANALYSIS

PE-CEIv.-701-1

3L-0T-0P: 03Credits

1. Coring Program: Objectives, Coring Tool, Core Types.
2. Core Sampling and Core Preparation: Introduction, Core Cutting, Core Plugging, End Facing, Core Cleaning, Core Drying, Core Preservations.
3. Core Analysis: Importance of Core Analysis, Conventional Core Analysis, Special Core Analysis.
4. Core Flooding: Importance of Core Flooding, Core Flooding methods, determination of Connate Water Saturation, Original Oil In Place (OOIP), Oil Recovery Efficiency, Residual Oil Saturation, Relative Permeability Curve.

Text Book References:

1. Recommended Practices for Core Analysis: Recommended Practice 40- American Petroleum Institute.
2. Core Analysis- Teknica Petroleum Services Limited.
3. Experimental Reservoir Engineering Laboratory Workbook-O. Torsaeter and M. Abtahi

SUBJECT: ADVANCED PRODUCTION ENGINEERING AND MANAGEMENT

PE-CEIv.-701-2

3L-0T-0P: 03Credits

Unit I: Production Enhancement: An overview of various production enhancement techniques, Well Analysis and Remedial Measures, Low Productivity – Stimulation, Excessive Production of unwanted fluid, Water Control, Sand Control, Production Optimization.

Unit-II: Stimulation: Concept of Formation damage, Type & description of Stimulation Techniques to mitigate formation damage problem and address issues of low productivity, Design of Matrix Acidization and Acid Fracturing. Design of Hydraulic Fracturing, Multistage Fracturing.

Unit III: Control of Excessive Production of fluids and solids: Reasons for excessive production of oil and gas, causes and hazards of excessive sand production, Water Control Techniques, Sand Control Techniques.

Unit IV: Production Optimization: Modelling, Monitoring and Control, optimization processes.

TEXT / REFERENCE BOOKS:

1. Dr. GuoBoyun, Computer-Aided Petroleum Production Engineering
2. H Dale Begg, Production Optimization, OGCI Publication, Tulsa.
3. Petroleum Engineering Handbook-Howard B. Bradley.

SUBJECT: OFFSHORE OPERATIONS

PE-702

3L-0T-0P: 03Credits

UNIT I

Introduction to offshore oil and gas operations. Sea States and Weather: Meteorology, oceanography, ice, sea bed soil. Analyses of Sea environment: Wind, waves and current forces- Characteristics, analysis and force evaluation. Buoyancy and stability, Offshore platforms & their stability, Buoyant force calculation.

UNIT II

Offshore Fixed Platforms: Types, description, operations and installation, Bracing & framing patterns in offshore structures.

Offshore Mobile Units: Types, description and installation. Station keeping methods like conventional mooring & dynamic positioning system.

Offshore Drilling: Difference in drilling from land, from fixed platform, jackup, ships and semi submersibles. Use of conductors and risers. Deep sea drilling.

UNIT III

Offshore Well Completion - Platforms and subsea completions, Deep water applications of subsea technology.

Offshore Production: Oil processing platforms, gas processing platforms, water injection platforms, storage, SPM and SBM, transportation and utilities.

UNIT IV

Deep water technology: Introduction, definition & prospects. Deep water regions, Deep water drilling rig – selection and deployment, Deep water production system, Emerging deep water technologies – special equipment and systems, Remote operation vessels (ROV).

UNIT V

Divers and Safety: Principles of diving use of decompression chambers, life boats. Offshore Environmental Pollution and Remedial Measures, Corrosion in offshore structures and its protection.

UNIT VI

Application of AI and ML in Off-shore drilling operations.

BOOKS:

1. Handbook of offshore engineering, S. K. Chakrabarti, Volume 1 & 2, Elsevier, 2005.
2. Handbook of Offshore Oil and Gas Operations, James G. Speight, Gulf Professional Publishing, 2014.
3. Offshore Petroleum Drilling and Production, SukumarLaik, CRC Press, Taylor & Francis Group,
4. Hydrodynamics of offshore structures, S. K. Chakrabarti, WIT Press.
5. Matrix methods of structural analysis, P. N. Godbole, R. S. Sonparote, S. U. Dhote, PHI Learning Private Limited, 2014.

SUBJECT: PETROLEUM FORMATION AND EVALUATION

PE-703

2L-0T-0P: 02Credits

1. Petrophysical measurements to sub-surface engineering.
2. Indirect Methods: SP and resistivity logs, radioactive logs, acoustic logs (principles, types of tools, limitation and applications). Evaluation of CBL/ VDL, USIT, SFT, RFT.
3. Production Logging: Introduction, type of tools, principles, limitations and applications.
4. Special Type of Logging Tools: Casing inspection tools (principles, application and limitation), Formation micro scanner (FMS), DSI, NMR logging principles. Logging in high-angle wells.

5. Log Interpretation and Analysis Techniques.

- a) Standard log interpretation methods.
- b) Cross-plotting methods: neutron-density, sonic-density and sonic-neutron etc.
- c) Clean sand interpretation
- d) Concepts of invasion – RXO, Tornado charts.
- e) Shale sand interpretation.

Text Book References-

1. Well Logging II: Electric and Acoustic Logging- James R. Joeden, Frank L. Campbell
2. Encyclopedia of Well Logging- Robert Desbrandes
3. Geophysical Well Logging- J. P. Vaish

COURSE CONTENTS

8TH SEMESTER

SUBJECT: ENERGY ECONOMICS

PE-OELv.-801-1

3L-0T-0P: 03Credits

1. Introduction to Energy, Primary and Secondary Energy Resources, Commercial and Non-Commercial Energy, Commercial Energy Production, Renewable and Non-Renewable Energy, Importance, limitations to primary sources.
2. Major Primary Energy Sources in India (Coal, Oil, and Natural Gas), nuclear energy, thermal energy, Commercial Energy and Non Commercial Energy, Primary Energy supply and Present Consumption Trend in India.
3. Energy Needs of Growing Economy, Long Term Energy Scenario (Future prospects of Gas Hydrates, CBM & Shale Gas etc in India), Energy Pricing in India.
4. Energy and Environment: Air Pollution, Climate Change, the Greenhouse Effect.
5. Energy Security, Energy Conservation and its Importance, Energy Strategy for the Future, Energy Conservation Act-2001 and its Features.
6. Statutory guidelines in Indian Energy Sector: Various statutory bodies of Indian Government involved with the entire energy sector in India such as DGH, OISD.

References:

1. Online Energy Journals/Publications
2. Government Guidelines
3. Published Papers
4. Energy Economics (2nd Edition), By Peter M. Schwarz
5. Handbook on the Economics of Renewable Energy by Pablo del Río and Mario Ragwitz
6. Energy Economics: Concepts, Issues, Markets and Governance Hardcover – by Subhes C. Bhattacharyya

SUBJECT: COMPUTATIONAL FLUID DYNAMICS

PE-OELv.-801-2

3L-0T-0P: 03Credits

Unit – I

Governing equations of fluid dynamics:

Substantial derivative, Divergence of velocity, continuity, momentum, energy equations. Physical boundary conditions. Forms of governing equation suited for CFD- shock fitting and shock capturing approach. Mathematical behavior of Partial difference equations- hyperbolic, parabolic and elliptic equations.

Discretization:

Finite difference method- Central, Forward, Backward difference for a uniform grid – Central difference expressions for a non-uniform grid - Numerical error - Accuracy of solution. Explicit and implicit approach. Errors and Stability analysis.

Grid Transformation:

Direct and In-direct transformation, Metric and Jacobians. Stretched grids, boundary fitted grids. Structured and unstructured grids.

Heat transfer:

Conduction Heat Transfer- Applications of Heat conduction - Steady and Unsteady conductions – numerical solutions of one and two dimensional steady and unsteady state problems.

Some simple CFD techniques:

Numerical solution of the incompressible Navier-Stokes equations: Stream function-vorticity formulation; Primitive variable formulation; Pressure correction techniques like SIMPLE, SIMPLER.

Texts/References:

1. Muralidhar, K., and Sundararajan, T., "Computational Fluid flow and Heat Transfer", Narosa Publishing House.
2. Ghoshdasdar, P.S., "Computer simulation of flow and heat transfer", Tata McGraw – Hill, New Delhi.
3. Anderson, D. A., Tannehill, J. L, and Pletcher, R.H., "Computational fluid mechanics and Heat Transfer", Hemisphere Publishing Corporation.
4. John David Anderson, "Computational Fluid Dynamics: The Basics with Applications", McGraw Hill, New York

SUBJECT: OCCUPATIONAL HEALTH AND SAFETY

PE-801

3L-0T-0P:03Credits

Unit-I: Health Hazards in Petroleum Production Refining and Utilization

1. Introduction to national and international safety and environment management.
2. Toxicity, Physiological, Asphyxiation, respiratory and skin effect of Petroleum Hydrocarbons (including mixtures), sour gases (eg Hydrogen sulphide and carbon monoxide etc) with their thresh-hold limits.
3. Effect of corrosive atmosphere and additives during acidizing, sand control and fracturing jobs etc.

Unit –II: Safety System

1. Introduction to API grades and standards related to Petroleum Industry.
2. Hazards analysis, developing a safe process, failure mode analysis, safety analysis (API-14C) safety analysis function evaluation chart (synergic approach).
3. Manual & atmospheric shut down system, blow down systems.
4. Gas detection system
5. Fire detection and suppression systems.
6. Personal protection systems & measures.

7. HSE Policies, standards & specifications
8. Disaster & crisis management.
9. Qualitative and quantitative risk analysis techniques, safety practices in drilling, production and design of installation.
10. Safety regulation -mines act, oil mines regulation, petroleum rule, petroleum act, atomic ERB rules, explosive act, explosive rule, occupational health hazards in hydrocarbon industries.

Unit-III: Environment

1. Environment concepts, impact on eco-system, air, water and soil.
2. The impact of drilling & production operations on environment, Environmental transport of petroleum wastes.
3. Offshore environmental studies, offshore oil spill and oil spill control.
4. Oil mines regulations and other environmental legislations.
5. Environmental impact assessment.
6. Waste treatment methods, waste disposal method, remediation of contaminated sites.
7. Air & noise pollution.
8. Biodiversity.
9. **Application of AI and ML in Health, Safety, Security and Environment:** Role of AI and ML in Health, Safety, Security and Environment; Latest concerns HSSE; Improvement of outcomes using AI and ML.

Text/Reference Books

1. Occupational Safety and Health for Technologists, Engineers, and Managers (7th Edition) (Alternative Etext Formats) by David L. Goetsch
2. Safety and Health for Engineers by Roger L. Brauer and Roger Brauer
3. Elements of Industrial Hazards: Health, Safety, Environment and Loss Prevention by RatanTatiya
4. Process Technology: Safety, Health, and Environment by Charles E. Thoma

SUBJECT: UNCONVENTIONAL ENERGY

PE-CEIv.-801-1

3L-0T-0P: 03Credits

1. Introduction and present status of coal bed methane and shale gas- Global and Indian Scenario
2. Properties of coal bed methane: Generation of coal bed methane gas and its properties, Coal gas origin, Coal rank, Ultimate and Proximate analyses, Cleats etc.
3. Measurement of Coal bed Gas content: Direct methods, Lost gas, Residual gas etc.
4. Sorption of gases: Sorption isotherms, Langmuir's equation, under saturation.
5. Overview of Drilling and Production systems, well completion techniques, etc.

SUBJECT: SHALE GAS/ OIL

PE-CEIv.-801-2

3L-0T-0P:03CREDITS

1. Global Scenario of shale gas/ Oil production.
2. Nature, origin and distribution of Shale Gas/ Oil.
3. Characterization of Shale for Production of Shale Gas/ Oil.
4. Extraction methods of Shale gas/ Oil: development of current practices.
5. Location and size of production areas: estimated reserves and economics.
6. Environmental issues in shale gas exploration.
7. Markets and Global impact on energy scenario.
8. Economic factor of shale Gas/ oil production